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Drugs and Sports

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Analysis

Alberta Alcohol and Drug Abuse Commission
An Agency of the Government of Alberta

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Alberta Alcohol and Drug Abuse Commission
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I) DEFINITIONS/TERMINOLOGY

Doping:	The athletes word for drug-taking. Defined by the Sports Medicine Council of Canada as: "the deliberate or inadvertent use of substances by an athlete for the purpose of enhancing athletic performance".
Ergogenic drug/aid:	Any substance or method believed to aid or improve athletic performance.
Androgens:	Male sex hormones responsible for development of the male secondary sex characteristics such as growth of facial hair and deepening of the voice. Testosterone is the major natural androgen; it is also an anabolic steroid.
Steroids:	a) Anabolic: Ergogenic drugs used to promote nitrogen retention and so aid the build-up of proteins (anabolism). This may cause the development of bigger muscles. Drugs used are derived from testosterone. b) Other: Corticosteroids are another group of steroids that are used in the treatment of inflammation, for example: arthritis, asthma, and various skin disorders.
Blood-packing or blood-doping:	An example of an ergogenic aid used in sports. Blood removed from the athlete several weeks before an event is concentrated and reinjected several days before the event.
Stacking:	A term used by athletes when more than one steroid is taken at one time.

II) INTRODUCTION

> "Popeye is weak and tired. He needs something to give him quick energy, bulging muscles, and superhuman strength..... He pulls out a can of spinach and gulps down its contents. Presto. No one, not even the bully Bluto, can stop him now."

This is not the first time these words have been used to introduce a discussion of drugs and sports.[1] The actions of Popeye, the well known cartoon character, make a number of points. In our society, enhancing performance by artificial means is not new, nor is the idea of a "quick drug fix" for problems. However, recently drugs and sports have received massive world-wide publicity. Thanks must go to Canada's own Ben Johnson and the Dubin Inquiry embarked on by the Canadian government after Johnson was stripped of his gold medal at the 1988 Seoul Olympics. Following all this publicity: Will our society and in particular will sporting bodies and athletes learn from the misfortunes of Ben Johnson? Can we limit the use of drugs in sports? And, can we establish a healthier approach to athletic endeavours at all levels?

Certainly, performance-enhancing substances are not new; they have been used by athletes for well over 2000 years. At the Ancient Olympic Games, athletes used special diets and ingested various substances believed to augment their physical capabilities.[2]

Modern use, however, probably dates back to swimmers in the 1865 Amsterdam canal races. Also, about that time, the coaches of six-day bicycle riders were widely known to be giving the heroin-and-cocaine mixture called "speedballs" to increase the endurance of team members.[3] The first reported drug-related death in sports was probably that of Arthur Linton, who died in 1886, apparently after receiving a drug overdose from his trainer, during the Bordeaux to Paris bicycle race.[2] Sadly, many better documented drug-related deaths have occurred since--in numerous different sporting events.[2,3]

Today, use of drugs is no longer limited to the elite of the sports world. Users range from world-class amateurs and highly paid professionals to college, high school, and even junior high school performers.[1] A recent disturbing trend is the use of anabolic steroids by young males for purely cosmetic reasons, for example, to improve their appearance at the beach.[4]

In an effort to decrease drug use in sports, the medical commission of the International Olympic Committee has developed policy regarding the classification of banned drugs and practices.[5,6] At virtually all international competitions athletes are selected in a random manner to undergo testing for the presence of banned drugs. Random testing during training would perhaps go a step further in reducing drug use. Unfortunately, new drugs and practices are constantly being developed in attempts to get around the bans and gain that all important "competitive edge".

Some informed people suggest that rather than a medico-legal question, doping in sports is really an ethical and moral concern that should be addressed by society as a whole.[7] For the present, we can at least supply accurate information about the drugs and the possible toxicity associated with their use.

This report has been prepared to help AADAC staff and other interested persons respond to questions about drugs and sports, in particular, about the harmful effects of using anabolic steroid drugs. The AADAC library is a good source of additional information on this subject.[1,2,3]

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III) DRUGS USED IN SPORTS

Drug use has been associated with most sporting events; recently, anabolic steroid use by Olympic athletes has received the most attention. However, a variety of other drugs are also used. Not surprisingly, drugs such as marihuana, alcohol and cocaine can cause problems for athletes; attempts to treat steroid withdrawal may lead to increased use of the intoxicant drugs.

The ergogenic drugs, such as the anabolic steroids and stimulants, are used in an attempt to improve performance. Pain killers and anti-inflammatory drugs are used in an attempt to restore "normal" function.

Addiction workers are all too familiar with many of these drugs, but may not have considered them in the context of sports. The most commonly used drugs will each be discussed briefly; the anabolic steroids will be examined in more detail.

1. Ergogenic Drugs

Many substances have been used by athletes in an attempt to increase performance beyond what would be achieved without them. This discussion will include the more important ergogenic drugs, including those most commonly used, and those which cause the greatest toxicity. On both counts, anabolic steroids and stimulants (including amphetamines and cocaine) are especially important.

For a discussion of some of the less commonly used ergogenic substances/aids, see: Reference #3 (Goldman), pp. 97-111.

1.1 Anabolic steroids

1.1.1 Introduction

Of the drugs used in sports, the anabolic steroids are a major concern. They are widely available, frequently used, and have the potential to very seriously damage the users' health.

The two main sources of anabolic steroids have been: legal, from doctors and illicit, from a variety of sources. The supply from physicians should decrease, as they become more aware of the dangers and ethical concerns associated with steroid use. However, doctors will still be faced with the difficult question of how to deal medically with persons taking illicit steroids.

Increasingly, the use of anabolic steroids by athletes is being considered a form of drug abuse. The U.S. National Institute on Drug Abuse is now funding research in this area,[8] and terms such as "steroid pusher" are entering our lexicon. However, recognition of the problem is not new: in 1980, an entire issue of the Journal of Drug Issues was devoted to drugs (including steroids) and sports.[9]

In the past, illicit anabolic steroids were mainly available through friends, particularly at the local gym; as availability has decreased and prices increased, there is now evidence that a more organized network of supply is developing.[10]

Some of the more commonly used anabolic steroids include: testosterone, oxymetholone (Anapolon-50 ®), stanozolol (Winstrol ®), nandrolone (Durabolin ®), methandrostenolone (Dianabol®), oxandrolone (Anavar®).

The clearest medical indication for the use of anabolic steroids is to replace inadequate production by the testes.[11] However, they have also been used: to treat certain types of severe anemia, to promote remissions in breast cancer patients, and to rebuild muscle or other tissue atrophied because of inactivity or wasted by diseases such as cancer. In addition, anabolic steroids are used to treat hereditary angioedema [12] (a rare disorder in which tissues swell abnormally), and are being tested as a possible treatment of osteoporosis [13].

1.1.2 Extent of Use

As with other drugs used illegally, it is difficult to accurately assess the extent of use. In their 1989 survey of almost 4,000 Ontario male and female students between Grades 7 and 13, the Addiction Research Foundation report that 1.1% had used anabolic steroids at least once in the past year.[14]

In the U.S., a recent national study found that 6.6% of 12th grade male high school students use or had used anabolic steroids,[15,16] while another study reported that 11% of 853 male students had used or were using steroids.[4] Reported use of steroids seems to be quite variable as only 1% of high school athletes in Ohio reported use.[17] A study of 2,282 U.S. college athletes reported that 5% used steroids.[18]

The comprehensive American high school study [15] revealed a disturbing pattern of use. While 47.1% of the students hoped to improve performance, and 10.7% were treating an injury, 26.7% were taking anabolic steroids merely to enhance their appearance. Use of steroids for cosmetic purposes is a particularly unwise use of such potent drugs, and this diffuse group of users will probably be very difficult to reach with prevention programs.

It has been suggested that anabolic steroid use is not as extensive in Canada because less emphasis is placed on sports. However, Dr. Douglas Coleman, a Vancouver family physician and former competitive power lifter, estimates that the number of people using steroids in B.C.'s lower mainland alone is "somewhere between 5,000 and 10,000".[19]

Media reports from Calgary[20], Edmonton[21], and Winnipeg[22] suggest that high school students across Canada are using anabolic steroids in an attempt to improve athletic performance and also simply to look good. There is an urgent need for further studies of the extent of steroid use by various groups in Canada, so that prevention programs can be implemented.

Another possible non-sports related use of anabolic steroids is to increase muscle mass in occupations where physical size could contribute to job performance or perceived ability to perform a job. Recently, the Police Chief in Houston, Texas proposed random drug testing of his men after a patrolman, that is a body builder, fatally fired six shots into an armed off-duty security guard he had stopped for speeding. Although the Chief did not link the killing to steroids it was suggested that as the drugs make users emotionally unstable and aggressive, they could have been a factor.[23]

Amongst athletes, anabolic steroids were at first used almost exclusively by weight lifters and heavy throwers; their use later spread to football players, swimmers, and other track and field participants.[24] In recent years, use has increased dramatically among athletes in a variety of sports and it has been estimated that athletes in at least 18 Olympic sports may be using steroids.[25]

1.1.3 Toxicity

Much has been written about the toxicity of the anabolic steroids. While differing opinions about the severity have been expressed, there is no question that they are toxic drugs.[26,7] Further research will help clarify the issue, however, the real toxicity of illicit steroids--as they are often used--will never be known. It would be unethical to study such high doses and unusual combinations of drugs. Also, because the source of supply is often illicit, the actual drug, and its purity are unknown.

The use of veterinary products in humans adds yet another variable. These are the same unknowns associated with the use of any illicit drug.

The known toxicity of the anabolic steroids includes:

Major Side Effects

i) Heart and blood vessels

Recent studies confirm that anabolic steroids adversely effect blood cholesterol levels.[27,28,29] They decrease HDL cholesterol (the "good" or protective portion) and increase LDL cholesterol (the "bad" portion associated with coronary heart disease).[30,31] The precise clinical significance of these finding is not known. However, two case reports--one of a serious heart attack [32] and the other of a stroke [33]--in young weight lifters taking steroids, are consistent with these changes in cholesterol levels.

Long term use of anabolic steroids can possibly also contribute to high blood pressure.[3,34]

ii) Liver [24,26,35]

A variety of liver disorders have been associated with the anabolic steroids. Least serious are changes in liver function which appear to return to normal when the drug is stopped. More serious, but rarely reported disorders include: inflammation of the liver (peliosis hepatitis) and benign and malignant tumors. Twenty-three cases of peliosis hepatitis have been reported, all in patients being treated for medical illnesses. Of 43 confirmed cases of liver tumor only three were in athletes taking steroids.

iii) Other cancers [3,30]

Two other potentially fatal cancers may be associated with anabolic steroid use: Wilms' tumor of the kidney and leukemia. However, they have been reported so infrequently in steroid users, that steroids may not have been the cause.

Minor Side Effects

These toxic effects can be considered minor because they are generally not fatal, however, they can result in significant damage to the users' body and seriously impair ability to function normally within society.

i) Psychosocial effects [3,36,37,38]

Do anabolic steroids cause dependence and tolerance? Athletes report feelings of euphoria when they take steroids and feelings of depression when they stop--both effects could lead to psychological dependence. Also, a physician in California has reported an opiate-like withdrawal experienced by a steroid user he treated.[39] Apparently tolerance to the effect of anabolic steroids can occur, as users tend to increase their dose to produce the desired effects. Although the evidence is less than complete, it would seem that once started, dependence and associated withdrawal, may contribute to continued steroid use [40]; or just as significantly, could lead to dependence on other drugs of abuse taken to control the effects of the steroids.

Major psychiatric symptoms may be another quite common effect of taking anabolic steroids. In one study, of 41 bodybuilders and football players using steroids, 12% displayed psychotic (serious psychiatric) symptoms.[41] This finding is consistent with the commonly reported "'roid rage" and at times violent aggressiveness associated with steroid use.[42]

Symptoms such as sleep disturbances and nightmares are also reported by steroid users.

ii) Hormonal effects [30]

In males, anabolic steroids suppress the normal production of the male sex hormone testosterone. The result is: testicular shrinkage, loss of libido (sexual desire), decreased sperm counts close to the point of sterility, and acne. It would appear that these changes are reversible when the steroids are stopped, however, there is a need for further studies of these very significant effects. Also, enlarged breasts and premature male pattern baldness are associated with steroid use in males.

In females, the masculinizing effects include: deepening of the voice, male pattern baldness, excess hair growth, and enlargement of the clitoris.[30,43] With prolonged use, these effects can be irreversible.[11] Changes that occur in the menstrual cycle are usually reversible, however, the long term effects on reproductive function in both females and males is unknown.

In addition to masculinizing effects, in prepubertal children, anabolic steroids can cause permanent early closure of the bone growth plates and result in life-long short stature.

iii) Other effects

As anabolic steroids are often injected, all the dangers associated with the non-medical injection of drugs can result. AIDS is a real danger when needles and syringes are shared--several cases with no other risk factor have already been reported.[44,45] Also, other infections can occur, as can serious reactions to injecting inappropriate material.

Increased injuries to muscles and tendons are often reported with the use of steroids.

1.1.4 Effectiveness

An evaluation of the effectiveness of the anabolic steroids and other drugs used by athletes to gain that all important "winning edge" is beyond the scope of this report. However, brief consideration is warranted.

There continues to be a lack of clear evidence that anabolic steroids significantly enhance athletic ability. Nevertheless, many coaches and athletes seem to be convinced that these drugs are effective and that they are necessary for success in international competition.

In their detailed review of the subject, Haupt & Rovere[24] concluded that at least some studies have shown increases in strength, body size, and body weight during administration of steroids. However, these effects have only been seen in athletes intensively trained in weight lifting immediately before and during the steroid regimen, and if the athletes maintain a high-protein diet. Of course, no data are available on the huge doses and combinations of drugs used by some athletes.

As part of any discussion of drug use in sports it is important to recognize: i) the psychological effects of believing that a drug or procedure can improve performance (placebo effect[3,46]) and ii) the improvement in physical performance resulting from the use of psychological techniques such as relaxation, bio-feedback, or of a good old fashioned pep-talk.

Therefore, while it is inaccurate to claim that steroids can **not** improve performance, current evidence that they do is very limited.

1.2 Stimulants

For many years, stimulants have been the drug of choice for a relatively small group of substance abusers. In the 60's and early 70's, amphetamines were the popular drug amongst this group. During the 80's cocaine, and its derivative crack, has become the stimulant most frequently used. Those working in the substance abuse area are familiar with cocaine and the other stimulant drugs. Reliable, updated sources of information are now widely available.[47,48]

1.2.1 Amphetamines[1,2,3]

In sports, amphetamines have been used mostly as ergogenic aids rather than for pleasure or to escape life's problems. They have been used in many different sports, particularly those calling for great stamina and endurance. Amphetamines have apparently been used widely in American football--in an attempt to increase the extreme aggression seen in that sport.

Because of increased government regulation, professional league monitoring, and increased urine testing, these drugs are probably being used less now than in the past. There is also increased recognition that despite the fact the user feels more capable, their actual performance is probably not significantly improved. Finally, athletes may be acknowledging the accepted "street" lore from the early 1970's: "speed kills".

Of current concern is the increasing popularity of free-base methamphetamine ("ice") comparable to free-base cocaine ("crack") that is being seen on the street in various U.S. cities. As a longer acting stimulant, it too will probably be used by athletes if it becomes more widely available.

1.2.2 Cocaine[1,2,3]

Athletes are amongst the wealthy celebrities that have been associated with the increasing use of cocaine during the 1980's. Cocaine has probably been used more as an escape or pleasure producing drug than the amphetamines, but is also used for its supposed ergogenic effect. Some writers suggest that cocaine is replacing amphetamines in attempts to improve performance.[1] There is no evidence that it is any more effective or less dangerous than the amphetamines.

1.2.3 Caffeine[2,3]

Our society's most commonly used stimulant, caffeine, is present in: coffee, tea, chocolate, and cola drinks. Because of the potentially harmful effects of using large doses, the International Olympic Committee has banned excess amounts of caffeine. A urine specimen is considered positive if it contains about ten times the amount that would be present after consuming an "average" amount of coffee.[2] No positive cases of caffeine doping have been reported.

1.3 Vitamins & Other Nutritional Supplements

Nutritional supplements are not usually regarded as doping agents because they are not banned under current legislation. However, they are commonly used by many athletes. One has only to open a copy of almost any sporting magazine--in particular those relating to body building--to realize just how popular they are. It seems that every possible supplement has been tried: high doses of vitamins, special diets, protein supplements, carbohydrate-loading and alkali salts, to name just a few. Although one author "feels that dietary aids have value"[3], most deny any improved performance except in the rare situation a specific deficiency exists.[2,49] Quite beyond the tremendous waste of money, high doses of vitamins can be toxic, as can large doses of other supplements. Athletes need to be told repeatedly that muscles are best enlarged and strengthened by a combination of exercise and calories from any source (carbohydrate, fat, or protein).

1.4 Other Ergogenic Aids

1.4.1 Blood-doping

Blood-packing or blood-doping involves removing blood from the athlete and concentrating the red blood cells. Over a number of weeks the body replaces the removed blood cells. Then, several days before an endurance event the stored red blood cells are reinfused.

It would appear that if sufficient blood is withdrawn and reinfused, more oxygen is carried to the muscles and sporting performance is improved.[2] This procedure is not without risk when carried out under ideal clinical circumstance by qualified professionals; it is dangerous under any other circumstances. A few of the possible complications include: infection (hepatitis and AIDS being of specific concern), abnormal blood clotting, and serious reactions if the wrong blood is reinfused. Blood-doping is now included on the International Olympic Commission restricted list.[6]

1.4.2 Erythropoietin

Erythropoietin, a newly available drug that has the same effect as blood-doping is being tested on athletes in Sweden. It is a naturally occurring hormone that stimulates production of red blood cells by the bone marrow, and has also been banned by the International Olympic Commission.[50, 51]

2. Restorative Drugs

Whereas ergogenic drugs are taken in an attempt to increase athletic performance beyond what would normally be achieved, restorative drugs are taken in an attempt to return (or restore) function to "normal". Some restorative drugs are used openly and legally, for example: to assist athletes to compete following an injury. With these drugs it is less clear when use becomes abuse and what restrictions should apply.

2.1 Pain Killers & Anti-inflammatory Drugs

Frequently, injured athletes are treated--with local anesthetic injections or cooling sprays on the skin--so they can continue competing. Soothing rubs and balms are also legal and commonly used.

However, the International Olympic Committee has banned a number of substances that are used for the treatment of inflammation and prolonged pain-relief. All narcotics such as codeine and morphine are banned. Some anti-inflammatory drugs such as the corticosteroids and ACTH (which controls the release of corticosteroids from the adrenal gland) are banned. Other anti-inflammatory drugs such as Aspirin®, ibuprofen, and phenylbutazone (Butazolidin®), are not banned.

Drug dependence is an obvious danger of using narcotics more than for short-term pain relief. Also, most of the other pain relievers and anti-inflammatory drugs have variable, often serious, side-effects. Another important consideration is that pain is a warning of injury. Masking the pain and continuing to function, particularly when extreme exertion is involved, may cause permanent damage to the affected part.

So, the decisions regarding drug use in sports to relieve pain and chronic inflammation are very important, and perhaps,even more complex than decisions regarding the use of the ergogenic drugs.

2.2 Anti-anxiety Drugs[2]

While many sports emphasize the need for physical fitness or strength, performance in others depends largely on the ability to relax. As a result, anti-anxiety drugs have been used in: target sports (shooting, archery, darts and golf), certain combat sports (fencing), and sports with a danger element (ski-jumping, and bob-sleighing).

The most commonly used drug is alcohol, but benzodiazepine tranquillizers, including diazepam (Valium®) and chlordiazepoxide (Librium®) are also used. These drugs are not prohibited under current IOC legislation. As with the pain killers and anti-inflammatory drugs, for the anti-anxiety drugs it is not that simple to differentiate legitimate drug use from abuse. This is particularly true for alcohol.

The beta-adrenergic blocking drugs such as propranolol (Inderol®) have also been used as "anti-anxiety" drugs. Beta-blockers are used to help calm various performers in the fields of music and the arts, as well as in sports. They decrease the effect of adrenalin released when the body is under stress or tension, so can help control performance or pre-competition jitters and butterflys. These drugs have caused considerable controversy in sporting events, and owing to their potentially harmful effects and possible use as doping agents, they have been banned by the International Shooting Union, and are also prohibited by the International Olympic Committee.

2.3 Other Restorative Drugs

A variety of other drugs including muscle relaxants, sedatives and the relatively new drug DMSO (Dimethyl sulphoxide) have been used in an attempt to restore athletic function to "normal". As with some of the other medically prescribed drugs it is not always obvious when use becomes abuse or what "normal" function is. However, the situation with DMSO is more clear cut, as it is not an effective treatment of muscle injuries, and has a clear potential of producing serious side effects in man.[3]

3. Other Drugs of Abuse

3.1 Marihuana

Like alcohol, is probably used for its calming, tranquillizing effect.

3.2 Alcohol

See: Anti-anxiety drugs.

3.3 Cocaine

See: Ergogenic drugs.

3.4 Nicotine/tobacco

Smoking is probably recognized by most athletes as harmful to their health; no controlled studies of effects on sporting performance have been done.[2]

As all these drugs are commonly used and abused in our society, it is not surprising that they are also used and abused by athletes.

4. Miscellaneous Drugs

4.1 Brake Drugs[1,2,3]

It has been suggested that certain hormone antagonist drugs could delay, or "put the brakes on" normal body development. Such delayed growth and maturity, would be a real advantage for young female gymnasts. At present, however, there is no evidence that such drugs are being used. Rumours of drug abuse by Eastern European countries could simply be an angry reaction to the success enjoyed by athletes from these countries.[2] Furthermore, as various coaches maintain, rigorous training and careful attention to diet could produce the same effect without using drugs.

4.2 Human growth hormone

Human growth hormone is a naturally occurring hormone that is reportedly being used by athletes in an attempt to enhance performance.[52,53] Its use during childhood will prevent dwarfism in children lacking this hormone. Athletes use the drug in hopes of increasing body growth and strength; these effects have not been proven. In the past, it was in very limited supply because the only source was pituitary glands of human cadavers. Now that growth hormone is made synthetically, it is more widely available, and as it is not yet a banned drug, is believed to be used quite extensively by athletes. The various damaging effects of illicit use of growth hormone include acromegaly--the overgrowth of bone resulting in protruding forehead and jaw and enlarged hands and feet.

4.3 Other drugs

Attempts to avoid detection of drug use have varied from ingenious methods of substituting "clean" urine (eg: injecting it into the athlete's bladder), to taking various "masking drugs". The latter include diuretic drugs which increase urine production thus diluting any drugs present, making them more difficult to detect.

Diuretics have also been used in sports where competition is carried out according to weight classifications. They are a dangerous way of trying to lose weight prior to the "weigh in", because in addition to increasing excretion of water by the kidneys, they can result in serious disturbances in the body electrolyte balance.[5]

IV) SUMMARY AND CONCLUSIONS

1. Drug use by Canadian athletes is an important societal concern. This is not a new phenomenon, but has recently been widely publicized; little information is available about the extent of such drug use.

2. Use of drugs in sports is increasingly being recognized as part of the spectrum of substance abuse.

3. A wide variety of drugs are involved, ranging from: anabolic steroids to commonly used intoxicants such as alcohol and marihuana.

4. An ergogenic drug/aid is a substance or method believed to aid or improve athletic performance.

5. Anabolic steroids are frequently used ergogenic drugs. These drugs are synthetic derivatives of the male sex hormone testosterone.

   i) Extent of Use: In a 1989 survey, 1.1% of Ontario male and female students, between Grades 7 and 13, reported use of steroids in the past year.

   Although steroid use by students in the United States is probably higher than in Canada, variable rates have been reported--from as low as 1% to as high as 11%. A recent nation-wide survey in the U.S. found that 6.6% of male high school students admitted to steroid use.

   ii) Toxicity: There is agreement that the anabolic steroids are toxic drugs; there are differing opinions regarding the severity.

   - Major disease of the heart and blood vessels **could** result from adverse effects on blood cholesterol levels, also, serious liver disease and potentially fatal cancers of other organs **may** be associated with steroid use.

   - More definitive evidence associates steroid use with a number of psychosocial disorders and hormonal effects. Reported psychiatric symptoms include violent aggression ("'roid rage"), and sleep disturbances and nightmares.

   - Possible hormonal effects in the male include: testicular shrinkage, loss of libido (sexual desire), decreased sperm counts, enlarged breasts, acne, and premature baldness. Although these effects are probably reversible when the steroid is stopped, there are no guarantees this will occur.

   - Masculinizing effects in the female include: deepening of the voice, male pattern baldness, excess hair grow and enlargement of the clitoris. With prolonged use, these effects can be irreversible.

   - The long-term effects on reproductive function in both females and males is unknown.

   - Steroid use is particularly dangerous in prepubertal children as it can prevent further growth and result in life-long short stature.

iii) Cosmetic use: Considering the potentially serious toxic effects, the apparently not uncommon use of steroids to merely improve appearance seems especially unwise. This diffuse group of users (26.7% in the nation-wide U. S. study) will probably be particularly difficult to reach with prevention programs.

iv) Effectiveness: Although it is inaccurate to claim unequivocally that steroids can **not** improve athletic performance, current research evidence that they do, is very limited.

6. Other substances that have been used for reputed ergogenic effects include stimulants (amphetamines, cocaine and caffeine) and vitamins and other nutritional supplements.

7. Blood-packing or blood-doping is an example of an ergogenic aid used in sports. In this procedure, used mostly in endurance events, blood--removed from the athlete several weeks before an event--is concentrated and reinjected several days before the event.

8. Restorative drugs are used in an attempt to return (or restore) function to "normal". Drugs that have been used include: pain killers, anti-inflammatory drugs, and anti-anxiety drugs.

9. Not surprisingly, the drugs used by athletes include intoxicants such as alcohol, marihuana and cocaine.

10. Several other drugs are reportedly used in sports.

    - There are reports of so called "brake drugs" being used to delay body development in young female gymnasts.

    - Human growth hormone is taken in an attempt to increase body growth and strength.

    - "Masking drugs" (diuretic drugs which increase urine production) are taken to dilute other drugs present in the urine and make them more difficult to detect.

    - Diuretics have also been used to produce weight loss in sports where competition is carried out according to weight classifications.

V) REFERENCES

1. Dolan, E.F. (1986). Drugs in Sports. New York: Franklin Watts.
   Drugs in Sports is well organized, concise, yet quite comprehensive. It is one of three (see references 2 and 3) particularly useful books about drugs and sports available in the AADAC library. All three are written in layman's terms. References 1 and 2 cover most drugs of abuse; the emphasis in reference 3 is on steroids.

2. Donohoe, T., & Johnson, N. (1986). Foul play: Drug abuse in sports. New York: Basil Blackwell Ltd.
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3. Goldman, B., Bush, P., & Klatz, R. (1984). Death in the locker room: Steroids and sports. South Bend, Indiana: Icarus Press.
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